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Research notes: Preliminary studies for screening techniques on shade tolerance of soybean

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Table 3

Male-sterile allelism tests between Rampage male sterile and $\underline{Ms_3ms_3}$

	T274 x $\underline{Ms_3ms_3}$							
	3:1 segregation				9:7 segregation			
	Total fertile	Total sterile	d.f.	χ^2	Total fertile	Total sterile	d.f.	χ^2
Totals	1326	421	13	8.40	984	786	8	3.43
Pooled χ^2			1	0.76			1	0.31
Homogeneity χ^2			14	7.64			9	3.12

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1) Inheritance of resistance to necrotic strain of SMV in soybean.

A necrotic strain of soybean mosaic virus (SMV) is one of the most destructive diseases in some leading soybean cultivars of Korea and its infection sometimes causes complete loss of the crop. The necrotic disease reported first as a strain of soybean mosaic virus in 1976, affects the most promising commercial cultivars, 'Kwangkyo' and 'Gangrim', which have been cultivated extensively since released in 1969. Hence, an investigation on the mode of inheritance of resistance gene in soybean cultivars was undertaken to develop resistant lines to the necrotic virus disease by mutation technique, which is being carried out with the cultivar Kwangkyo at present.

Paschal and Goodman (1978) reported resistance to a severe isolate of soybean mosaic virus in cultivar 'Buffalo' to be conditioned by one or more dominant genes. Three resistant soybean cultivars and a Korean native line were engaged to cross with the susceptible cultivar Kwangkyo. The F_1 plants for each of the four crosses were grown in the field, and flower, pubescence and seed coat colors were used as genetic markers to verify the hybridization. Both F_1, F_2 plants and parents were grown in the field and inoculated with extract of infected leaves by conventional rubbing method at 2-4 leaf stage, being put aphids to enhance natural infection, too.

The F_1 hybrids of each cross between Kwangkyo and #31926, KEX-2, 'Kumgang-daerip', KAS 390-10 were susceptible, indicating that resistance is controlled by recessive gene (Table 1). In determination of disease reactions of the F_2 populations, it was segregated in a ratio of 3 susceptible to 1 resistant, thus confirming that resistance is conditioned by a single recessive gene. For further evidence, backcrosses and F_3 generations are to be

Table 1

Segregation of infection types of F_1, F_2 and parents inoculated with necrotic strain of soybean mosaic virus

Exp. no.	Cross	Generation	Number of plants			χ^2 value	P value (3:1)
			Resistant	Susceptible	Total		
I	Kwangkyo(S)[a]	P_1		28	28		
	x	P_2	30		30		
	#31926(R)	F_1		10	10		
		F_2	52	128	180	1.45	0.10-0.25
II	Kwangkyo(S)	P_1		30	30		
	x	P_2	30		30		
	KEX-2(R)	F_1		6	6		
		F_2	6	16	22	0.06	0.75-0.90
III	Kwangkyo(S)	P_1	1	29	30		
	x	P_2	30		30		
	Kumgang-daerip(R)	F_1		6	6		
		F_2	3	15	18	0.66	0.25-0.50
IV	Kwangkyo(S)	P_1		30	30		
	x	P_2	28		28		
	KAS390-10(R)	F_1		8	8		
		F_2	6	20	26	0.04	0.50-0.75

[a]Disease reaction; R = resistant and S = susceptible.

tested. From the results, it is expected that resistant mutants induced from the cultivar Kwangkyo by irradiation will be selected in a few generations without drastic changes of other agronomic characters of the mother variety.

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2) Preliminary studies for screening techniques on shade tolerance of soybean.

Soybean intercropping with other crops usually causes poor yield, mainly by light reduction. Sometimes, a continuous rainfall during the growing season in the area of monsoon is a major factor for yield reduction in soybean by insufficient sunlight as well as shading by intercropping.

Recently our laboratory has collected over 1500 lines as germplasm for Korean native soybean lines and has conducted tests for evaluation of various agronomic characters. With this work, we are interested in selecting the genetic physiological lines adaptable to inadequate growth conditions. Hence, the objective in this study was to determine the effects of light reduction on several agronomic characters to establish an effective screening technique for shading tolerance.

From our germplasm, 16 collected lines having differences in plant type, number of nodes and several growth habits were used for the experiment. Shade treatment was established for 15 days by covering with reeds at a height of 120 cm on the plants from east to west direction and a total of 5 treatments at various growth stages was made during the period 6 July to 18 September 1978. Light reduction in covered plots was estimated at around 56% as compared with control plots.

Response to shade treatment was significantly different among the engaged soybean lines. In general, overgrowth of plant height, reduced number of branch and seed size appeared in second shading period, whereas number of nodes was not affected by shading. Number of pods and seed yield per plant were significantly decreased in all the shading treatments from late flowering to pod filling stages. Consequently, it could be suggested that shading treatment during the pod filling stage would be most effective.

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1) Soybean plant design for closed ecological life support system.*

Prior to the establishment of the space habitats of the future, the life science program office of the National Aeronautics and Space Administration (NASA) is interested in the development of a ground-based manned demonstration of the closed ecological life support system (CELSS). Since CELSS concept centers around complete recycling of all available resources, a genetic plant design to render the total plant more useful is very important. Previous studies (Phillips, 1977; Phillips et al., 1978) conducted for NASA clearly indicate the usefulness of soybean plants in such a system. It has been suggested that 43% of the cropped area in the manufacturing facility in space be planted under soybeans for feed and food in the space habitat (Phillips, 1977). Research on screening and selection of early maturing and high yielding soybean cultivars has also been recommended (Phillips et al., 1978). We feel that besides being early maturing and high yielding, soybean plant should have high seed yield efficiency (SYE). SYE can be defined as the ratio of seed to non-seed dry matter weight. Highly efficient plants, out of the total energy required, will utilize relatively more energy for the production of seed and less for non-seed plant parts. It is possible to select soybean cultivars

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